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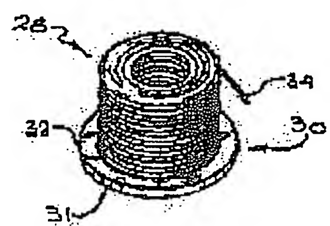
(54) FLANGE SUPPORTING TYPE SENSOR COIL FOR FIBER-TYPE OPTICAL GYROSCOPE

(57)Abstract:
PURPOSE: To reduce the thermal inductive Shub effect, by shaping an optical fiber into a coil formed by plural coaxial turn layers, burying the same into the potting material, and fixing the same in such manner that the coil axis is vertical to the flat attachment flange.
CONSTITUTION: A sensor coil 28 is bonded to a disc-shaped flat member 31 of an attachment flange 30 through an adhesive layer 32. The coil 28 is formed by winding the continuous optical fiber 34 onto a winding spool into the predetermined shape. The coil 28 is made to be impregnated with the potting material at the time during and after the winding, and is hardened, and the winding spool is removed from the coil 28, to obtain the self-supporting shape. Thereby the flange 30 loses the compressive stress in the axial without preventing the elongation of the coil 28 in the axial, and the Shub effect bias can be reduced.



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CLAIMS

[Claim(s)]
[Claim 1] a) The continuous optical fiber substantially prepared by the coil which serves as a flat mounting flange from two or more layers of b coaxial turn, c) The turn of said coil so that it may be embedded into the pot-ized ingredient of the preselected presentation and the shaft of the d aforementioned coil may become perpendicular substantially at said mounting flange The rotation sensor for fiber type optical gyroscopes characterized by consisting of combination of means ** for fixing said coil to said flange.
[Claim 2] Setting in a rotation sensor according to claim 1, the 1st part of the a aforementioned coil is said rotation sensor by which it is substantially fixed to the 1st flat field of a flat mounting flange, and the 2nd part of the b aforementioned coil is characterized by said thing [being substantially fixed to the opposed face of a flat mounting flange] further.
[Claim 3] It is a rotation sensor including a means for said flange to lead said continuous optical fiber between said 1st [the] of said coil, and the 2nd part in a rotation sensor according to claim 2.
[Claim 4] A rotation sensor including the means for maintaining the alignment with which engaged with said flange and the shaft of said coil was further decided to be beforehand in the rotation sensor according to claim 3.
[Claim 5] a rotation sensor according to claim 4 -- setting -- said mounting flange -- further -- the shape of a tubing -- substantial -- a flat disk member and b -- the hub established in the core of said tubular disk, and c -- the rotation sensor by which said a part of hub contains ** of the front face of said disk member which has extended to shaft orientations up and down.
[Claim 6] Said means for leading said continuous optical fiber in a rotation sensor according to claim 5 is a rotation sensor including at least one circular slot established in the periphery of said disk member.
[Claim 7] Said means for leading said continuous optical fiber in a rotation sensor according to claim 5 is a rotation sensor of a fiber turn arranged so that said optical fiber may be led among one fourth at least.
[Claim 8] In a rotation sensor according to claim 5 said hub Said cylindrical wall consists of a shaft-orientations part of the 1st and 2nd thickness. furthermore, a cylindrical wall and b -- The field near the 2nd edge where said wall counters while the field near the 1st edge of said wall has said 1st thickness has said 2nd thickness. The c aforementioned wall The rotation sensor containing ** which changes from said 1st thickness to the 2nd thickness over the middle shaft-orientations field near the joint of said wall and said disk member.
[Claim 9] Said means for maintaining the alignment the shaft of said coil was beforehand decided to be in a rotation sensor according to claim 8 is a rotation sensor which includes further the means for carrying out the alignment of a plinth and the b aforementioned plinth to said shaft decided beforehand, and the means for maintaining the direction where said mounting flange was beforehand decided about the c aforementioned coil.
[Claim 10] a rotation sensor according to claim 9 -- setting -- further -- a -- said mounting flange -- from titanium -- becoming -- b -- said plinth -- from stainless steel -- becoming -- c -- said plinth -- a step -- containing -- d -- the 2nd thickness of said cylindrical wall -- the 1st thickness -- large -- becoming -- **** -- e -- the rotation sensor characterized by what said step is [the

thing] in contact with said 1st edge of said hub.

[Claim 11] The means for maintaining the alignment decided beforehand in a rotation sensor according to claim 10 is a rotation sensor for fixing said 2nd edge of said hub which contains a flat attachment component substantially further.

[Claim 12] The rotation sensor which includes the means for fixing said supporting structure to said plinth further in a rotation sensor according to claim 11.

[Claim 13] a) the continuous optical fiber substantially prepared by the coil which serves as a flat mounting flange from two or more layers of b coaxial turn, and c -- the 1st part of said coil It is fixed to the 1st flat field of a mounting flange flat on said real target. The 2nd part of the d aforementioned coil It is fixed to the opposed face of a mounting flange flat on said real target. The e aforementioned flange The means for leading said continuous optical fiber between said 1st [the] of said coil and the 2nd part is included. Said means includes at least one circular slot prepared near the periphery of said mounting flange. f) The turn of said coil so that it may be embedded into the pot-ized ingredient of the presentation decided beforehand and the shaft of the g aforementioned coil may become perpendicular substantially at said mounting flange The rotation sensor for fiber type optical gyroscopes characterized by consisting of combination of the means for fixing said coil to said flange, and means [for maintaining the alignment with which engaged with the h aforementioned flange and the shaft of said coil was beforehand decided to be] **.

[Claim 14] It is a mounting flange flat on the real target which consists of titanium. Substantially [the shape of (i) tubing] a) A flat disk member, (ii) -- the mounting flange in which a part of hub established in the core of said disk member and said (iii) hub contain ** of the front face of said disk member which has extended to shaft orientations up and down, and b -- said hub Furthermore, (i) cylindrical wall and the (ii) aforementioned cylindrical wall consist of a shaft-orientations part of the 1st and 2nd thickness. The field near the 2nd edge where said wall counters while the field near the 1st edge of said wall has said 1st thickness has said 2nd thickness. Said (iii) wall The continuous optical fiber prepared by the coil which consists of two or more layers of c coaxial turn including ** which changes from said 1st thickness to the 2nd thickness over the middle shaft-orientations field near the joint of said wall and said disk member, d) The turn of said coil so that it may be embedded into the pot-ized ingredient of the presentation decided beforehand and the shaft of the e aforementioned coil may become perpendicular substantially at said mounting flange It is a means for maintaining the alignment the layer of the adhesives for fixing said coil to said flange and the shaft of the f aforementioned coil were beforehand decided to be. This means (i) The plinth made from stainless steel, and the means for carrying out alignment of the (ii) aforementioned plinth to said shaft decided beforehand, The means for maintaining the direction where said coil was related and said mounting flange was decided beforehand, (iii) (iv) A flat attachment component is included substantially for fixing said 2nd edge of said hub. g) -- said plinth -- a step -- containing -- h -- the 2nd thickness of said cylindrical wall -- the 1st thickness -- large -- becoming -- **** -- i -- the rotation sensor for fiber type optical gyroscopes characterized by said step consisting of combination of ** which is in contact with said 1st edge of said hub.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the sensor coil for fiber type optical gyroscopes. Especially this invention is temperature induction Shupe (Shupe) resulting from fiber stress. In order to decrease effectiveness, it is related with the equipment which supports a pot-like sensor coil.
[0002]
[Description of the Prior Art] A fiber type optical gyroscope consists of the following main components. That is, they are (1) light source, (2) beam splitters (either the direction coupler of fiber optics, or integrated optics Y branch), (3) fiber-optics coil, (4) polariscopes (and the time one or more polarization disappearance machines), and (5) detectors. The light from the light source is divided into a propagation wave and the back propagation wave which gets across to a detection coil by the beam splitter. Related electronics measures the phase relation between two back propagation light beams which are generated from the both ends of a coil and in which it interferes. The difference of the phase shift experienced with two beams offers the criteria of the turnover of the bench that the instrument is being fixed.
[0003] An environmental factor may affect the phase shift difference between the back propagation beams measured, and, thereby, may carry in bias, i.e., an error. Said environmental factor contains temperature, vibration (an acoustical thing and mechanical thing), and a variate like a field. These change with time amount, and are not uniform to the everywhere of a coil, are distributed over it, and cause change of the refractive index and die length which encounter as each back propagation wave progresses the inside of a coil. The phase shift added by said two waves produces equally the phase shift which distinction does not attach and which is not desirable as for net from a rotation calling-on signal. One approach for decreasing the sensibility produced from an environmental factor needed use of a symmetry mold coil coil gestalt. In said coil, while the core on the structure of this coil is located in an innermost layer, a coil is prepared so that two edges of this coil may be located in the outermost layer.
[0004] N FURIGO (N. Frigo) "Compensation of Linear Sources of Non-reciprocity in Signal Interferometers", Fiber Optics and Laser Sensors I, Prcs.SPIE, Vol.412, and p.261 (1989) It set and use of the specific coil pattern for compensating non-reciprocity was advocated. Furthermore, BEDONARUTSU entitled a "fiber type light detection coil" (Bednarz) U.S. Pat. No. 4,793,708 is teaching the symmetry fiber type light detection coil formed by two poles or 4 pole coil. The coil indicated by this patent shows the reinforced engine performance in which the conventional spiral type coil is excelled. Ivancevic who entitles "4 Pole coil mold fiber type light detection coil and its manufacture approach" (Ivancevic) U.S. Pat. No. 4,856,900 is conquered by replacing between connection layers with the turn wall with which a fiber bundle and the minute crookedness resulting from existence of the pop-up fiber segment which adjoins an edge flange go up said pop-up segment and which is rolled in the said alignment. Both the United States patents mentioned above are the ownership of the grantee in here.
[0005] fang (Huang) entitled "the equipment for decreasing the field induction bias error in a fiber type optical gyroscope" etc. -- pending in court -- patent application 08th / No. 017 or 678 are tackling oppression of the bias error caused by the Faraday effect of the sensor coil exposed to the field. Invention indicated by this application (ownership of the grantee in here) is teaching the use and the design of a compensation loop formation which neutralize the effect of the field

turned to both radial and shaft orientations. In any case, it is added by the compensation loop formation in order that the torsion of extent the fiber torsion mode decided beforehand was beforehand decided to be may make the disciplinary Faraday effect to neutralize.

[0006] Cordoba (Cordova) entitled "the sensor coil for low bias fiber type optical gyroscopes" etc. -- pending in court -- the problem of the addition relevant to ********** that the United States patent application 07th / No. 938,294, and this are also the ownership of the grantee in here is tackled. Although it follows and can have effect strong against bias stability, temperature sensitivity, bias temperature gradient sensibility, bias oscillating sensibility, bias MAG sensibility, scale-factor temperature sensitivity, scale-factor linearity, and input-shaft temperature sensitivity, the equipment of a gyroscope with the random design of a sensor coil indicated by this application is indicating the coil formed on the spool made from a graphite composite material near it of the fiber coil which has a coefficient of thermal expansion upwards. This coil is made into the shape of a pot with adhesives. If said application does not have as if that the thermal-expansion property of not only proper selection of a coil pot-ized ingredient but a spool and a fiber coil balances mostly, it will lessen bias like Shupe caused with the thermal stress which will be applied with a standard metal spool as much as possible. Furthermore, careful selection of a pot(especially modulus of elasticity related)-ized ingredient results in oscillating induction bias, a coil crack, degradation of a h parameter, and reduction of temperature gradient bias sensibility.

[0007] Although it is useful for it to be useful to use of the graphite composite material for a spool lessening stress as much as possible, and to pot-ize a coil coil by the adhesive substrate, that of "inserting in" is difficult for the conventional spool [support-cum-] design which was sandwiched between the edge flanges of a pair and which is substantially characterized by the cylinder-like mandril in a pot-like coil. This originates disproportionately [expansion of said coil according to a temperature change]. The coefficient of thermal expansion of the pot-like coil in shaft orientations may become 100 times as much order as that radial. Making it a misfortune, corresponding non-balance does not exist about a support spool. Rather, the conventional design and a spool of an ingredient presentation show an isotropic thermal-expansion property. This relative imbalance introduces the bias error by coil stress, and makes junction and a crack problem. For example, in a spool and coil arrangement with the ingredient almost near the radial coefficient of thermal expansion of a pot-like coil of a mandril, expansion of the shaft orientations of a coil will exceed it of a mandril. Consequently, since expansion of shaft orientations is restricted at intervals of the separation "does not change" between the edge flanges of a spool comparatively, considerable compression of the shaft orientations of a coil may take place. Furthermore, it may result in either a burst or a coil crack with the stress resulting from the difference of the coefficient of thermal expansion in a coil-mandril interface. With the mandril made from the ingredient which is equal to the coefficient of thermal expansion of the shaft orientations of a coil mostly on the other hand, expansion of a mandril radial [comparatively big] is expected according to a temperature change, a radial dimension presses the fiber of the coil which does not change comparatively, and the engine performance may be degraded. Although the bias effectiveness guided in environment evokes considerable attentiveness of the proper design of a sensor coil as mentioned above, it hardly brings attentiveness to the thermal design of a related component. Furthermore, of course, said attachment equipment including a spool and a suppression means is in contact with the coil, therefore brings about a potential error generation source.

[0008]

[Means for Solving the Problem] This invention tackles the error generation source relevant to installation of the sensor coil for use by offering the rotation sensor for fiber optics gyroscopes which contains a flat mounting flange substantially. The continuous optical fiber is prepared in the 1st mode by the coil which consists of a layer of two or more coaxial turns. The turn of a coil is embedded into the pot-ized ingredient of the preselected presentation. The means for fixing a coil to a flange so that the shaft of a coil may intersect perpendicularly substantially to a mounting flange is offered.

[0009] In the 2nd mode, being fixed to the field where the 1st part of a coil is substantially fixed to the 1st flat field of a flat mounting flange, and the 2nd part counters is offered additionally. Said means includes at least one circular slot established in the periphery of a mounting flange including a means for a flange to guide the optical fiber which continued between the 1st and 2nd parts of a coil. The turn of a coil is embedded into the pot-ized ingredient of the preselected presentation. It engages with a flange and the means for maintaining the alignment the shaft of a coil was beforehand decided to be is offered.

[0010] as a substitute -- the voice of everything but this invention further -- like -- more -- substantial -- a flat mounting flange -- from titanium -- becoming -- the shape of (i) tubing -- substantial -- a flat disk member and (ii) -- it is offered that the hub established in the core of said tubular disk and said (iii) hub part contain ** of the field of a disk member which has extended to shaft orientations up and down.

[0011] Further said hub (i) cylindrical wall and the (ii) aforementioned cylindrical wall While the field near the shaft-orientations part of the 1st and 2nd thickness and the 1st edge of said wall has the 1st thickness The field near the 2nd edge where said wall counters has the 2nd thickness, and said (iii) wall contains ** which experiences the change in the 2nd thickness from the 1st thickness over the middle shaft-orientations field near the joint of said wall and disk member.

[0012] The means for maintaining the alignment the shaft of a coil was beforehand decided to be is offered. since said means fixes the 2nd edge of the means for carrying out alignment to the shaft which was able to determine said plinth beforehand, the means for maintaining the direction where the mounting flange was beforehand decided about the coil (iii), and (ii) (iv) hub with the plinth made from (i) stainless steel -- substantial -- a flat attachment component and (v) -- the means for fixing said attachment component to said plinth is included.

[0013] Said plinth contains a step. The 2nd thickness of the cylindrical wall of said hub exceeds the 1st thickness, and said step contacts the 1st edge of said hub. The description and advantage of the above of this invention and an addition will become still clearer from the following detailed explanation. The aforementioned explanation is accompanied by the drawing of a lot. The number of a drawing corresponded to the figure of the written explanation, and has pointed out the various descriptions of this invention. The same figure has pointed out the same description through both [which were written] a drawing and explanation.

[0014]

[Example] Next, when a drawing is referred to, drawing 1 is the perspective view of the sensor coil 10 for fiber optics gyroscopes. A coil 10 is conventionally attached in the spool 12 of a design, and offers the important component of fiber optics gyroscope equipment. At the time of use, it is fixed to the bench where rotation should be measured, and a coil 10 requires the means for carrying out the alignment of the detection shaft of that about the bench.

[0015] The coils 10 and spools 12 by which drawing 2 was taken by two to 2 line of drawing 1 are some fragmentary sectional views of a location. the core which carries out termination of the spool 12 by the edge flanges 16 and 18 of a pair so that it may see -- it consists of a cylinder-like

mandril 14 generally. The sensor coil 10 consists of one continuous optical fiber 20 were wound around the mandril 14 by the pattern decided beforehand. You may press ** carry out of the disc-like support 22 into a mandril 14, and the feed hole 24 for accepting the fastening which fixes a coil to the bench in the state of a desirable alignment may be included.

[0016] In order [of the coefficient of thermal expansion of an optical fiber 20 and this spool 12] to decrease a difference absolutely, spool 10 can consist of a carbon composite presentation so that it may consist of a metal presentation or may be taught by the United States patent application 07th under connection / No. 797,198. Thus, the temperature induction Shupe effectiveness stress is made into min to the highest order. That is [it embeds a fiber 20 at the substrate 26 which consists of adhesives so that it may be further taught by this application], it can pot-ize. In addition to increasing coil precision, the substrate which consists of a pot-ized ingredient gives a designer an opportunity to result in change to some performance characteristics. The sensibility to an oscillating induction bias error decreases by selection with especially careful pot-ized adhesives.

[0017] When choosing the ingredient of spool 12, it is desirable to ****** to make it balance with the heat multiplier of a coil 10. It cannot perform in essence making it a misfortune, this target being generally wound around a cylinder-like, shape of i.e., tubing, pattern, and the sensor coil 10 which was embedded at the substrate 26 which consists of a pot-ized ingredient and which consists of a continuous optical fiber 20 originating in the fact that the coefficient of thermal expansion of radial [remarkably different] and shaft orientations is probably shown, and attaining with an effective known ingredient. For example, with the typical pot-like coil, the anisotropy coefficient of thermal expansion of 4 ppm[/degree] C (radial) and 400 ppm[/degree] C (shaft orientations) is measured. Said non-balance of thermal expansion does not suit isotropic and non-directive DESAIN and the ingredient of spool 12 in essence about a comprehensive coefficient of thermal expansion.

[0018] <u>Drawing 3</u> is the perspective view of the sensor coil 28 which was combined with the mounting flange 30 according to this invention and which was explained above generally. Arrangement of <u>drawing 3</u> is indicating the basic form voice by which the independence coil 28 is joined to the disc-like even member 31 of a mounting flange 30 by the conventional glue line 32. A coil 28 is made by twisting the continuous fiber 34 around the configuration beforehand decided to be a coil spool first. a coil -- in process -- or a coil 28 is suitably infiltrated in a pot-ized ingredient after that. After a pot-ized ingredient hardens, the coil coil 28 is removed from a coil spool, and can acquire the shape of a self-standing type.

[0019] The arrangement shown in <u>drawing 3</u> decreases the Shupe hardening bias which observed that an artificer arose from the temperature induction stress of a fiber 34. The artificer pursued said bias to the incompatibility of a proper in the thermal-expansion property of a spool of the type which consists of the conventional pot-like coil and a cylindrical mandril of the core which carries out termination by the edge flange which faced each other. As mentioned above, the spool is isotropy although the coil is an anisotropy about a shaft orientations and radial thermal expansion. Probably, it turns out that it is only required that the gestalt of <u>drawing 3</u> should participate in one side of the coefficients of thermal expansion from which the coil 28 differed to the designer, since shaft orientations are made to lengthen the mounting flange 30 of this invention which does not have the edge flange or the same equipment to restrict by contrast, without pressing a coil. This loses the compression induction stress of the shaft orientations of the coil 28 which originates in a bigger expansion coefficient than that of the coil 28 in shaft orientations (as opposed to the expansion coefficient of the conventional mandril), and may be

produced in the conventional spool attachment. Expansion of the shaft orientations of a coil 28 is not pressed down by this invention, therefore compression reaction force does not appear. Furthermore, expansion of the shaft orientations of a coil 28 cannot make stress at the "base" from a coil to a mandril which may produce both the delamination of the coil from a mandril, and the crack which spreads the inside of the coil of an advanced-technology design on a square 45 degrees by removing the interface between inside coil layers most with the mandril of the conventional spool. Said crack is observed when internal stress exceeds the coating of a fiber coil, and the bond strength of junction between pot-ized ingredients. (Expansion of the shaft orientations of the fiber coil attached in the conventional spool made from aluminum may make the stress more than 500p.s.i)

[0020] Drawing 4 is the perspective view of other examples of this invention. Here the disc-like member 37 for a mounting flange 36 to hold the sensor coil 38 prepared in the one half 40 on the back and the front one half 42 -- containing -- "one half" -- 40 and 42 (in practice) since division of the coil to two parts did not have to be set to 50-50, this was mistaken -- calling -- the direction -- it is -- it is attached in the opposed face of the disc-like member 37. Although the example of drawing 4 will be indicated and it will be explained to a detail by the following, the advantage of the main concepts of said gestalt is related with the independence nature of the pot-like sensor coil 38. That there is no shaft-orientations support given with the mandril of the conventional core although effectiveness of the bias resulting from the disproportionate coefficient of thermal expansion of a sensor coil and others is made into an invalid makes exchange of the mandril of the core of the advanced technology, and a spool of the type of an edge flange expose to the stress which answers an environmental vibration which cannot avoid a coil (it originates in the property of a known pot-ized ingredient, and is easy to turn at some) easily. Since a coil and a mounting flange form cantilever equipment (- explained to the central hub-following of a mounting flange is not most in contact with an inside coil layer), the effectiveness of an environmental vibration becomes the most remarkable when oscillation frequency is in agreement with the natural frequency of a cantilever coil, i.e., resonance frequency.

[0021] Generally, the power spectrum density of an environmental vibration becomes max, and decreases after that in the 1100Hz neighborhood. It turns out that 1km sensor coil which was rolled by the orientation periodic pattern and was pot-ized with the conventional adhesives has the natural frequency of about 1100Hz. The resonance frequency of each one half is made to increase to 2,000Hz or more from which environmental active jamming becomes min by dividing a coil. For many applications decided by resonance coil structure, it is very advantageous to divide the die length of a cantilever sensor coil, and a result is obtained by arrangement of drawing 4 . In the case of 1km sensor coil which mentioned the above which is divided into the one half 40 and 42 of die length smaller than (it consists of a 500-meter optical fiber respectively), two coil segments are made and it has the resonance frequency of 2400Hz or more, respectively. This moves a coil 38 from the range of the considerable stress (therefore, the bias effectiveness) as a result of the mechanical oscillation guided in environment.

[0022] each of a mounting flange for drawing 5 A and drawing 5 B to support the division coil gestalt shown in front drawing -- they are a bottom view and a side elevation. A flange 44 consists of a disc-like flat member 46 which is combined with the main hub member 48 and generally extends through it so that it may see. The wall thickness of a hub 48 is changing along with the die length of the shaft orientations of the hub member 48 so that it may see below. This brings about association of the hub 48 to a plinth (not shown in drawing 5 A and drawing 5 B).

The mounting flange by which the coefficient of thermal expansion was suitably made from the titanium alloy which balances with the radial coefficient of thermal expansion of a pot-like coil mostly accepts the mount seat made from stainless steel by the thin-walled part of that which touches this plinth. In order to maintain the alignment of the input shaft with which it opted for rotation beforehand at the time of the plinth, otherwise radial existence of expansion which become disproportionate, and a coil, the thin-walled part of the wall of a hub 48 can have bigger flexibility, so that it may be explained below. The perimeter of the disc-like member 46 is equipped with the circular slots 50 and 52 which lead to slots 49 and 51 and it in order that a fiber may enable it to move gradually between the front section of a sensor coil, and the tooth-back section. The front face of the member 46 around which the 2nd one half of a division coil is wound is equipped with slots 50 and 52, and they offer the interior of a proposal which leads a fiber to the core of a member 46. (By preparing the receiving spool which is the outer diameter and the same axle of a hub 48, and has a bigger outer diameter than it first, it makes on a mounting flange 44, i.e., a division coil can be rolled.) Suitably, four pole coil patterns are used. After one one half of a division coil is first wound around one field of the disc-like member 48, the field of another side is started in the one half of another side of a division coil at a volume. As a substitute, a division coil may be wound around the method of inside from the periphery of the disc-like member 46.

[0023] in order that "migration" (namely, process until it come out of the last turn of the coil pattern in one field of a disk 46 and begin the turn of the beginning of the coil pattern in an opposed face) of a fiber may lessen installation of the minute deflection to the coil which may produce the optical bias effectiveness as much as possible, the edge slots 49 and 51 and the circular slots 50 and 52 be arrange so that it may be carry out gradually, they be make into a dimension, and be design. Suitably, this migration arrangement is allowed to be performed over three fourths of the fiber turns from the edge of the coil of one one half of a division coil to the start of the coil of the one half of another side of migration of a fiber. However, it is thought using the arrangement which obtains the migration covering [from a field to the field of another side / at least] 1 / 4 fiber turn on the other hand of the disc-like member 46 that said minute deflection can still be decreased considerably.

[0024] Drawing 6 is the sectional side elevation of the division coil by this invention which engaged with the plinth 58 for actuation, and mounting-flange arrangement. This equipment is put in in the mu factor (mu) metal shielding 54 connected with a substrate 56 so that it may see. The plinth 58 suitably made from stainless steel within casing formed with shielding 54 and a substrate 56 accepts the extension material 60 which forms some inertial navigation system (INS). The alignment of the extension material 60 is carried out to the shaft which is utility as an input shaft of the sensor coil 62 and which was decided beforehand. (Many optical and electric components are arranged in casing formed with shielding 54.) However, said component is unrelated to argument of this invention, therefore is omitted from drawing 6 .

The sensor coil 62 is divided into the front one half 64 and the one half 66 on the back, and consists of two or more turns of the optical fiber which continued, respectively. A coil 62 is attached on the disc-like member 68 of a mounting flange as shown in front drawing 3 thru/or 5. The wall thickness of the one half 70 of the front face of the central hub of the mounting flange supported in contact with the step 71 which goes around the surroundings of the plinth 58 made from stainless steel is thinner than the wall thickness of the one half of the rear face which does not contact a plinth. As mentioned above, the thinner wall thickness of the one half of the front face of a hub gives the flexibility which the neighborhood where the different plinth material and

different mounting-flange material of a coefficient of thermal expansion contact increased. whenever [consequently, / tilt-angle / of the disc-like member 68 of a mounting flange] -- equipment -- the plinth made from stainless steel -- " -- it is protected from the cardiac gap when being exposed to the excessive radial expansion by which "thermal induction was carried out, and contacting the wall of the one half of the front face of a hub. By including a certain amount of "resiliency" in this location, the posture of the disc-like member 68 can keep perpendicular on the detection shaft limited by the extension material 60 over the temperature requirement expected, therefore the sensor coil 62 will be left with the alignment carried out proper.

[0025] The maintenance plate 74 is located on the top of the rear face of an attachment flange hub, i.e., "thick" one half. Sequential immobilization is carried out with a bolt 80, and the whole assembly completes the "sandwiches" arrangement containing the maintenance plate 74, a plinth 58, and a substrate 56. In addition to the advantageous shift of the natural frequency of cantilever coil structure, division of the sensor to two parts separated relatively makes possible the opportunity of the equipment optimization which is not in the conventional coil design as mentioned above. The aforementioned possibility becomes the potential advantage of a proper in a "mixed" coil design. That is, a division coil gestalt provides a designer with the opportunity using the coil technique and pattern which are different when making the one half of the front face of the sensor coil 62, and a rear face. There is possibility of many designs. For example, it can transpose in accordance with the detection shaft of one of the coils of whether it is near the disc-like member 68, or to have shifted from it, the first half point, i.e., origin, of a coil of a front face and a rear face. Furthermore, the layer of the beginning of the one half of a front face or a rear face can be easily transposed to one of whether it is near or it sticks to a hub of the periphery of a disc-like member. Moreover, the layer (namely, layer by which the alignment was carried out to each perpendicular) to which the one half of the front face of a sensor coil and a rear face corresponds can be wound around an opposite direction. For example, the layer to which the one half of a front face and a rear face corresponds can be rolled in right-handed rotation and the direction of left-handed rotation. The above-mentioned degree of freedom provides a designer with the opportunity using the mixed coil which consists of two parts which constitute a sensor so that the counteraction effectiveness it is ineffective to nullification of the existing error generation source respectively may be acquired. Furthermore, a division coil design makes a designer take minimization of the effectiveness of an environmental factor into consideration. Since an alignment eclipse and coil sensibility become the function of the distance from a coil core so that more pans to an environmental factor may be carried out, the further minimization of environmental effectiveness can attain the one half 66 of the rear face of a division coil by beginning a coil coil process in one half on the back.

[0026] The sensor coil which was rolled according to this invention and attached showed the good result. Drawing 7 is a graph which offers the criteria of the stability of detection axial center doubling as a function of temperature. The division coil arrangement by instruction of this invention was used for 1km sensor coil. The temperature of a mounting flange circulated through between -55-degreeC and 65-degreeC so that it might see from the graph of drawing 7 . The input axial center doubling temperature coefficient of 0.02 arc second / **C was measured with 0.38 arc second's thermal fitting error. This engine performance was fully included in the design specification of 0.3 arc second / **C (input axial center doubling temperature coefficient), and 1.5 arc second / **C (heat fitting error). The oscillating engine performance of 1km division coil system by this invention was satisfactory similarly. By dividing 1km coil into two cantilever type one half, the mechanical stress resulting from vibration of the environment-range does not cause

the harmful resonance within coil structure.

[0027] Drawing 8 A and drawing 8 B are the graphs of the temperature-time amount property about 1km coil and the mounting flange by this invention, and the bias error produced as a result. The known shoe PUERA multiplier left the remaining temperature dependence error, and was easily made from the data of drawing 8 B. It circulated through the temperature of a mounting flange between -45-degreeC and 65-degreeC so that it might see. The residual bias of 0.0092 or less degrees per time amount was observed over 21 hours after compensation of the Shupe temperature effect. This is contained within the limits of the clearly acceptable gyroscope engine performance.

[0028] Therefore, this invention offers the sensor coil arrangement for fiber type optical gyroscopes which offers the improved bias engine performance. A bias error common to the pot-ized sensor coil arrangement attached in the conventional spool can be remarkably decreased by arranging a mounting flange, a coil, and a plinth according to this invention. Although this invention was explained about the example suitable at present, it does not restrict to it. Rather, this invention is restricted only in the limitation defined by the claim, and includes all the equivalents of it within the limits of it.

TECHNICAL FIELD

[Industrial Application] This invention relates to the sensor coil for fiber type optical gyroscopes. Especially this invention is temperature induction Shupe (Shupe) resulting from fiber stress. In order to decrease effectiveness, it is related with the equipment which supports a pot-like sensor coil.

EFFECT OF THE INVENTION

It is made to move from the range of (therefore, the bias effectiveness).

[0022] each of a mounting flange for drawing 5 A and drawing 5 B to support the division coil gestalt shown in front drawing -- they are a bottom view and a side elevation. A flange 44 consists of a disc-like flat member 46 which is combined with the main hub member 48 and generally extends through it so that it may see. The wall thickness of a hub 48 is changing along with the die length of the shaft orientations of the hub member 48 so that it may see below. This brings about association of the hub 48 to a plinth (not shown in drawing 5 A and drawing 5 B). The mounting flange by which the coefficient of thermal expansion was suitably made from the titanium alloy which balances with the radial coefficient of thermal expansion of a pot-like coil mostly accepts the mount seat made from stainless steel by the thin-walled part of that which touches this plinth. In order to maintain the alignment of the input shaft with which it opted for rotation beforehand at the time of the plinth, otherwise radial existence of expansion which become disproportionate, and a coil, the thin-walled part of the wall of a hub 48 can have bigger flexibility, so that it may be explained below. The perimeter of the disc-like member 46 is equipped with the circular slots 50 and 52 which lead to slots 49 and 51 and it in order that a fiber may enable it to move gradually between the front section of a sensor coil, and the tooth-

back section. The front face of the member 46 around which the 2nd one half of a division coil is wound is equipped with slots 50 and 52, and they offer the interior of a proposal which leads a fiber to the core of a member 46. (By preparing the receiving spool which is the outer diameter and the same axle of a hub 48, and has a bigger outer diameter than it first, it makes on a mounting flange 44, i.e., a division coil can be rolled.) Suitably, four pole coil patterns are used. After one one half of a division coil is first wound around one field of the disc-like member 48, the field of another side is started in the one half of another side of a division coil at a volume. As a substitute, a division coil may be wound around the method of inside from the periphery of the disc-like member 46.

[0023] in order that "migration" (namely, process until it come out of the last turn of the coil pattern in one field of a disk 46 and begin the turn of the beginning of the coil pattern in an opposed face) of a fiber may lessen installation of the minute deflection to the coil which may produce the optical bias effectiveness as much as possible, the edge slots 49 and 51 and the circular slots 50 and 52 be arrange so that it may be carry out gradually, they be make into a dimension, and be design. Suitably, this migration arrangement is allowed to be performed over three fourths of the fiber turns from the edge of the coil of one one half of a division coil to the start of the coil of the one half of another side of migration of a fiber. However, it is thought using the arrangement which obtains the migration covering [from a field to the field of another side / at least] 1 / 4 fiber turn on the other hand of the disc-like member 46 that said minute deflection can still be decreased considerably.

[0024] Drawing 6 is the sectional side elevation of the division coil by this invention which engaged with the plinth 58 for actuation, and mounting-flange arrangement. This equipment is put in in the mu factor (mu) metal shielding 54 connected with a substrate 56 so that it may see. The plinth 58 suitably made from stainless steel within casing formed with shielding 54 and a substrate 56 accepts the extension material 60 which forms some inertial navigation system (INS). The alignment of the extension material 60 is carried out to the shaft which is utility as an input shaft of the sensor coil 62 and which was decided beforehand. (Many optical and electric components are arranged in casing formed with shielding 54.) However, said component is unrelated to argument of this invention, therefore is omitted from drawing 6 .
The sensor coil 62 is divided into the front one half 64 and the one half 66 on the back, and consists of two or more turns of the optical fiber which continued, respectively. A coil 62 is attached on the disc-like member 68 of a mounting flange as shown in front drawing 3 thru/or 5. The wall thickness of the one half 70 of the front face of the central hub of the mounting flange supported in contact with the step 71 which goes around the surroundings of the plinth 58 made from stainless steel is thinner than the wall thickness of the one half of the rear face which does not contact a plinth. As mentioned above, the thinner wall thickness of the one half of the front face of a hub gives the flexibility which the neighborhood where the different plinth material and different mounting-flange material of a coefficient of thermal expansion contact increased. whenever [consequently, / tilt-angle / of the disc-like member 68 of a mounting flange] -- equipment -- the plinth made from stainless steel -- " -- it is protected from the cardiac gap when being exposed to the excessive radial expansion by which "thermal induction was carried out, and contacting the wall of the one half of the front face of a hub. By including a certain amount of "resiliency" in this location, the posture of the disc-like member 68 can keep perpendicular on the detection shaft limited by the extension material 60 over the temperature requirement expected, therefore the sensor coil 62 will be left with the alignment carried out proper.

[0025] The maintenance plate 74 is located on the top of the rear face of an attachment flange

hub, i.e., "thick" one half. Sequential immobilization is carried out with a bolt 80, and the whole assembly completes the "sandwiches" arrangement containing the maintenance plate 74, a plinth 58, and a substrate 56. In addition to the advantageous shift of the natural frequency of cantilever coil structure, division of the sensor to two parts separated relatively makes possible the opportunity of the equipment optimization which is not in the conventional coil design as mentioned above. The aforementioned possibility becomes the potential advantage of a proper in a "mixed" coil design. That is, a division coil gestalt provides a designer with the opportunity using the coil technique and pattern which are different when making the one half of the front face of the sensor coil 62, and a rear face. There is possibility of many designs. For example, it can transpose in accordance with the detection shaft of one of the coils of whether it is near the disc-like member 68, or to have shifted from it, the first half point, i.e., origin, of a coil of a front face and a rear face. Furthermore, the layer of the beginning of the one half of a front face or a rear face can be easily transposed to one of whether it is near or it sticks to a hub of the periphery of a disc-like member. Moreover, the layer (namely, layer by which the alignment was carried out to each perpendicular) to which the one half of the front face of a sensor coil and a rear face corresponds can be wound around an opposite direction. For example, the layer to which the one half of a front face and a rear face corresponds can be rolled in right-handed rotation and the direction of left-handed rotation. The above-mentioned degree of freedom provides a designer with the opportunity using the mixed coil which consists of two parts which constitute a sensor so that the counteraction effectiveness it is ineffective to nullification of the existing error generation source respectively may be acquired. Furthermore, a division coil design makes a designer take minimization of the effectiveness of an environmental factor into consideration. Since an alignment eclipse and coil sensibility become the function of the distance from a coil core so that more pans to an environmental factor may be carried out, the further minimization of environmental effectiveness can attain the one half 66 of the rear face of a division coil by beginning a coil coil process in one half on the back.

[0026] The sensor coil which was rolled according to this invention and attached showed the good result. Drawing 7 is a graph which offers the criteria of the stability of detection axial center doubling as a function of temperature. The division coil arrangement by instruction of this invention was used for 1km sensor coil. The temperature of a mounting flange circulated through between -55-degreeC and 65-degreeC so that it might see from the graph of drawing 7 . The input axial center doubling temperature coefficient of 0.02 arc second / **C was measured with 0.38 arc second's thermal fitting error. This engine performance was fully included in the design specification of 0.3 arc second / **C (input axial center doubling temperature coefficient), and 1.5 arc second / **C (heat fitting error). The oscillating engine performance of 1km division coil system by this invention was satisfactory similarly. By dividing 1km coil into two cantilever type one half, the mechanical stress resulting from vibration of the environment-range does not cause the harmful resonance within coil structure.

[0027] Drawing 8 A and drawing 8 B are the graphs of the temperature-time amount property about 1km coil and the mounting flange by this invention, and the bias error produced as a result. The known shoe PUERA multiplier left the remaining temperature dependence error, and was easily made from the data of drawing 8 B. It circulated through the temperature of a mounting flange between -45-degreeC and 65-degreeC so that it might see. The residual bias of 0.0092 or less degrees per time amount was observed over 21 hours after compensation of the Shupe temperature effect. This is contained within the limits of the clearly acceptable gyroscope engine performance.

[0028] Therefore, this invention offers the sensor coil arrangement for fiber type optical gyroscopes which offers the improved bias engine performance. A bias error common to the pot-ized sensor coil arrangement attached in the conventional spool can be remarkably decreased by arranging a mounting flange, a coil, and a plinth according to this invention. Although this invention was explained about the example suitable at present, it does not restrict to it. Rather, this invention is restricted only in the limitation defined by the claim, and includes all the equivalents of it within the limits of it.

TECHNICAL PROBLEM

[Description of the Prior Art] A fiber type optical gyroscope consists of the following main components. That is, they are (1) light source, (2) beam splitters (either the direction coupler of fiber optics, or integrated optics Y branch), (3) fiber-optics coil, (4) polariscopes (and the time one or more polarization disappearance machines), and (5) detectors. The light from the light source is divided into a propagation wave and the back propagation wave which gets across to a detection coil by the beam splitter. Related electronics measures the phase relation between two back propagation light beams which are generated from the both ends of a coil and in which it interferes. The difference of the phase shift experienced with two beams offers the criteria of the turnover of the bench that the instrument is being fixed.
[0003] An environmental factor may affect the phase shift difference between the back propagation beams measured, and, thereby, may carry in bias, i.e., an error. Said environmental factor contains temperature, vibration (an acoustical thing and mechanical thing), and a variate like a field. These change with time amount, and are not uniform to the everywhere of a coil, are distributed over it, and cause change of the refractive index and die length which encounter as each back propagation wave progresses the inside of a coil. The phase shift added by said two waves produces equally the phase shift which distinction does not attach and which is not desirable as for net from a rotation calling-on signal. One approach for decreasing the sensibility produced from an environmental factor needed use of a symmetry mold coil coil gestalt. In said coil, while the core on the structure of this coil is located in an innermost layer, a coil is prepared so that two edges of this coil may be located in the outermost layer.
[0004] N FURIGO (N. Frigo) "Compensation of Linear Sources of Non-reciprocity in Signal Interferometers", Fiber Optics and Laser Sensors I, Prcs.SPIE, Vol.412, and p.261 (1989) It set and use of the specific coil pattern for compensating non-reciprocity was advocated. Furthermore, BEDONARUTSU entitled a "fiber type light detection coil" (Bednarz) U.S. Pat. No. 4,793,708 is teaching the symmetry fiber type light detection coil formed by two poles or 4 pole coil. The coil indicated by this patent shows the reinforced engine performance in which the conventional spiral type coil is excelled. Ivancevic who entitles "4 Pole coil mold fiber type light detection coil and its manufacture approach" (Ivancevic) U.S. Pat. No. 4,856,900 is conquered by replacing between connection layers with the turn wall with which a fiber bundle and the minute crookedness resulting from existence of the pop-up fiber segment which adjoins an edge flange go up said pop-up segment and which is rolled in the said alignment. Both the United States patents mentioned above are the ownership of the grantee in here.
[0005] fang (Huang) entitled "the equipment for decreasing the field induction bias error in a fiber type optical gyroscope" etc. -- pending in court -- patent application 08th / No. 017 or 678 are tackling oppression of the bias error caused by the Faraday effect of the sensor coil exposed

to the field. Invention indicated by this application (ownership of the grantee in here) is teaching the use and the design of a compensation loop formation which neutralize the effect of the field turned to both radial and shaft orientations. In any case, it is added by the compensation loop formation in order that the torsion of extent the fiber torsion mode decided beforehand was beforehand decided to be may make the disciplinary Faraday effect to neutralize.
[0006] Cordoba (Cordova) entitled "the sensor coil for low bias fiber type optical gyroscopes" etc. -- pending in court -- the problem of the addition relevant to ********** that the United States patent application 07th / No. 938,294, and this are also the ownership of the grantee in here is tackled. Although it follows and can have effect strong against bias stability, temperature sensitivity, bias temperature gradient sensibility, bias oscillating sensibility, bias MAG sensibility, scale-factor temperature sensitivity, scale-factor linearity, and input-shaft temperature sensitivity, the equipment of a gyroscope with the random design of a sensor coil indicated by this application is indicating the coil formed on the spool made from a graphite composite material near it of the fiber coil which has a coefficient of thermal expansion upwards. This coil is made into the shape of a pot with adhesives. If said application does not have as if that the thermal-expansion property of not only proper selection of a coil pot-ized ingredient but a spool and a fiber coil balances mostly, it will lessen bias like Shupe caused with the thermal stress which will be applied with a standard metal spool as much as possible. Furthermore, careful selection of a pot(especially modulus of elasticity related)-ized ingredient results in oscillating induction bias, a coil crack, degradation of a h parameter, and reduction of temperature gradient bias sensibility.
[0007]

MEANS

[Means for Solving the Problem] This invention tackles the error generation source relevant to installation of the sensor coil for use by offering the rotation sensor for fiber optics gyroscopes which contains a flat mounting flange substantially. The continuous optical fiber is prepared in the 1st mode by the coil which consists of a layer of two or more coaxial turns. The turn of a coil is embedded into the pot-ized ingredient of the preselected presentation. The means for fixing a coil to a flange so that the shaft of a coil may intersect perpendicularly substantially to a mounting flange is offered.
[0009] In the 2nd mode, being fixed to the field where the 1st part of a coil is substantially fixed to the 1st flat field of a flat mounting flange, and the 2nd part counters is offered additionally. Said means includes at least one circular slot established in the periphery of a mounting flange including a means for a flange to guide the optical fiber which continued between the 1st and 2nd parts of a coil. The turn of a coil is embedded into the pot-ized ingredient of the preselected presentation. It engages with a flange and the means for maintaining the alignment the shaft of a coil was beforehand decided to be is offered.
[0010] as a substitute -- the voice of everything but this invention further -- like -- more -- substantial -- a flat mounting flange -- from titanium -- becoming -- the shape of (i) tubing -- substantial -- a flat disk member and (ii) -- it is offered that the hub established in the core of said tubular disk and said (iii) hub part contain ** of the field of a disk member which has extended to shaft orientations up and down.

[0011] Further said hub (i) cylindrical wall and the (ii) aforementioned cylindrical wall While the field near the shaft-orientations part of the 1st and 2nd thickness and the 1st edge of said wall has the 1st thickness The field near the 2nd edge where said wall counters has the 2nd thickness, and said (iii) wall contains ** which experiences the change in the 2nd thickness from the 1st thickness over the middle shaft-orientations field near the joint of said wall and disk member.
[0012] The means for maintaining the alignment the shaft of a coil was beforehand decided to be is offered. since said means fixes the 2nd edge of the means for carrying out alignment to the shaft which was able to determine said plinth beforehand, the means for maintaining the direction where the mounting flange was beforehand decided about the coil (iii), and (ii) (iv) hub with the plinth made from (i) stainless steel -- substantial -- a flat attachment component and (v) -- the means for fixing said attachment component to said plinth is included.
[0013] Said plinth contains a step. The 2nd thickness of the cylindrical wall of said hub exceeds the 1st thickness, and said step contacts the 1st edge of said hub. The description and advantage of the above of this invention and an addition will become still clearer from the following detailed explanation. The aforementioned explanation is accompanied by the drawing of a lot. The number of a drawing corresponded to the figure of the written explanation, and has pointed out the various descriptions of this invention. The same figure has pointed out the same description through both [which were written] a drawing and explanation.

EXAMPLE

[Example] Next, when a drawing is referred to, drawing 1 is the perspective view of the sensor coil 10 for fiber optics gyroscopes. A coil 10 is conventionally attached in the spool 12 of a design, and offers the important component of fiber optics gyroscope equipment. At the time of use, it is fixed to the bench where rotation should be measured, and a coil 10 requires the means for carrying out the alignment of the detection shaft of that about the bench.
[0015] The coils 10 and spools 12 by which drawing 2 was taken by two to 2 line of drawing 1 are some fragmentary sectional views of a location. the core which carries out termination of the spool 12 by the edge flanges 16 and 18 of a pair so that it may see -- it consists of a cylinder-like mandril 14 generally. The sensor coil 10 consists of one continuous optical fiber 20 were wound around the mandril 14 by the pattern decided beforehand. You may press ** carry out of the disc-like support 22 into a mandril 14, and the feed hole 24 for accepting the fastening which fixes a coil to the bench in the state of a desirable alignment may be included.
[0016] In order [of the coefficient of thermal expansion of an optical fiber 20 and this spool 12] to decrease a difference absolutely, spool 10 can consist of a carbon composite presentation so that it may consist of a metal presentation or may be taught by the United States patent application 07th under connection / No. 797,198. Thus, the temperature induction Shupe effectiveness stress is made into min to the highest order. That is [it embeds a fiber 20 at the substrate 26 which consists of adhesives so that it may be further taught by this application], it can pot-ize. In addition to increasing coil precision, the substrate which consists of a pot-ized ingredient gives a designer an opportunity to result in change to some performance characteristics. The sensibility to an oscillating induction bias error decreases by selection with especially careful pot-ized adhesives.

[0017] When choosing the ingredient of spool 12, it is desirable to ****** to make it balance with the heat multiplier of a coil 10. It cannot perform in essence making it a misfortune, this target being generally wound around a cylinder-like, shape of i.e., tubing, pattern, and the sensor coil 10 which was embedded at the substrate 26 which consists of a pot-ized ingredient and which consists of a continuous optical fiber 20 originating in the fact that the coefficient of thermal expansion of radial [remarkably different] and shaft orientations is probably shown, and attaining with an effective known ingredient. For example, with the typical pot-like coil, the anisotropy coefficient of thermal expansion of 4 ppm[/degree] C (radial) and 400 ppm[/degree] C (shaft orientations) is measured. Said non-balance of thermal expansion does not suit isotropic and non-directive DESAIN and the ingredient of spool 12 in essence about a comprehensive coefficient of thermal expansion.

[0018] Drawing 3 is the perspective view of the sensor coil 28 which was combined with the mounting flange 30 according to this invention and which was explained above generally. Arrangement of drawing 3 is indicating the basic form voice by which the independence coil 28 is joined to the disc-like even member 31 of a mounting flange 30 by the conventional glue line 32. A coil 28 is made by twisting the continuous fiber 34 around the configuration beforehand decided to be a coil spool first. a coil -- in process -- or a coil 28 is suitably infiltrated in a pot-ized ingredient after that. After a pot-ized ingredient hardens, the coil coil 28 is removed from a coil spool, and can acquire the shape of a self-standing type.

[0019] The arrangement shown in drawing 3 decreases the Shupe hardening bias which observed that an artificer arose from the temperature induction stress of a fiber 34. The artificer pursued said bias to the incompatibility of a proper in the thermal-expansion property of a spool of the type which consists of the conventional pot-like coil and a cylindrical mandril of the core which carries out termination by the edge flange which faced each other. As mentioned above, the spool is isotropy although the coil is an anisotropy about a shaft orientations and radial thermal expansion. Probably, it turns out that it is only required that the gestalt of drawing 3 should participate in one side of the coefficients of thermal expansion from which the coil 28 differed to the designer, since shaft orientations are made to lengthen the mounting flange 30 of this invention which does not have the edge flange or the same equipment to restrict by contrast, without pressing a coil. This loses the compression induction stress of the shaft orientations of the coil 28 which originates in a bigger expansion coefficient than that of the coil 28 in shaft orientations (as opposed to the expansion coefficient of the conventional mandril), and may be produced in the conventional spool attachment. Expansion of the shaft orientations of a coil 28 is not pressed down by this invention, therefore compression reaction force does not appear. Furthermore, expansion of the shaft orientations of a coil 28 cannot make stress at the "base" from a coil to a mandril which may produce both the delamination of the coil from a mandril, and the crack which spreads the inside of the coil of an advanced-technology design on a square 45 degrees by removing the interface between inside coil layers most with the mandril of the conventional spool. Said crack is observed when internal stress exceeds the coating of a fiber coil, and the bond strength of junction between pot-ized ingredients. (Expansion of the shaft orientations of the fiber coil attached in the conventional spool made from aluminum may make the stress more than 500p.s.i)

[0020] Drawing 4 is the perspective view of other examples of this invention. Here the disc-like member 37 for a mounting flange 36 to hold the sensor coil 38 prepared in the one half 40 on the back and the front one half 42 -- containing -- "one half" -- 40 and 42 (in practice) since division of the coil to two parts did not have to be set to 50-50, this was mistaken -- calling -- the

direction -- it is -- it is attached in the opposed face of the disc-like member 37. Although the example of drawing 4 will be indicated and it will be explained to a detail by the following, the advantage of the main concepts of said gestalt is related with the independence nature of the pot-like sensor coil 38. That there is no shaft-orientations support given with the mandril of the conventional core although effectiveness of the bias resulting from the disproportionate coefficient of thermal expansion of a sensor coil and others is made into an invalid makes exchange of the mandril of the core of the advanced technology, and a spool of the type of an edge flange expose to the stress which answers an environmental vibration which cannot avoid a coil (it originates in the property of a known pot-ized ingredient, and is easy to turn at some) easily. Since a coil and a mounting flange form cantilever equipment (- explained to the central hub-following of a mounting flange is not most in contact with an inside coil layer), the effectiveness of an environmental vibration becomes the most remarkable when oscillation frequency is in agreement with the natural frequency of a cantilever coil, i.e., resonance frequency.

[0021] Generally, the power spectrum density of an environmental vibration becomes max, and decreases after that in the 1100Hz neighborhood. It turns out that 1km sensor coil which was rolled by the orientation periodic pattern and was pot-ized with the conventional adhesives has the natural frequency of about 1100Hz. The resonance frequency of each one half is made to increase to 2,000Hz or more from which environmental active jamming becomes min by dividing a coil. For many applications decided by resonance coil structure, it is very advantageous to divide the die length of a cantilever sensor coil, and a result is obtained by arrangement of drawing 4 . In the case of 1km sensor coil which mentioned the above which is divided into the one half 40 and 42 of die length smaller than (it consists of a 500-meter optical fiber respectively), two coil segments are made and it has the resonance frequency of 2400Hz or more, respectively. This is the considerable stress as a result of the mechanical oscillation guided in environment in a coil 38.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view of the sensor coil for fiber optics gyroscopes attached in the conventional spool.

[Drawing 2] They are the sensor coil of drawing 1 taken along with two to 2 line of drawing 1 , and the fragmentary sectional view of a spool.

[Drawing 3] It is the perspective view of the sensor coil attached in the flat mounting flange by this invention.

[Drawing 4] It is the perspective view of the coil by other examples of this invention, and a mounting flange.

[Drawing 5 A] each of the mounting flange for supporting the division coil example of front drawing -- it is 1 of a bottom view and a side elevation.

[Drawing 5 B] each of the mounting flange for supporting the division coil example of front drawing -- it is 2 of a bottom view and a side elevation.

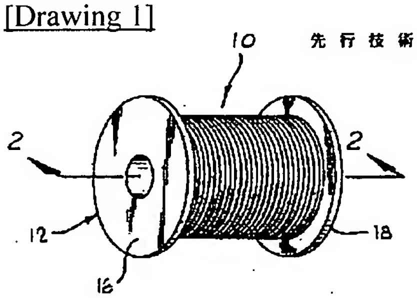
[Drawing 6] It is the sectional side elevation of the division coil by this invention which engaged with the plinth for actuation, and mounting-flange arrangement.

[Drawing 7] It is the graph of a detection axial center doubling error as a temperature function

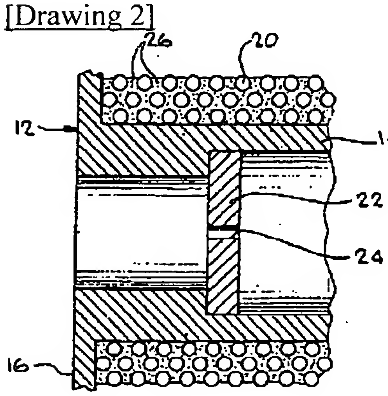
about the sensor coil attached by this invention.
[Drawing 8 A] It is each 1 of the graph of the temperature characteristic and a gyro bias error as a time function about the sensor coil by this invention.
[Drawing 8 B] It is each 2 of the graph of the temperature characteristic and a gyro bias error as a time function about the sensor coil by this invention.
[Description of Notations]
28 Sensor Coil
31 Disc-like Member
32 Glue Line
34 Fiber

DRAWINGS

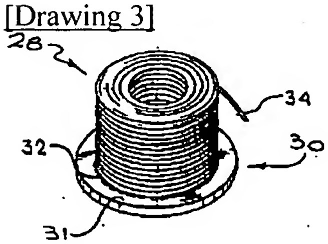
[Drawing 1]



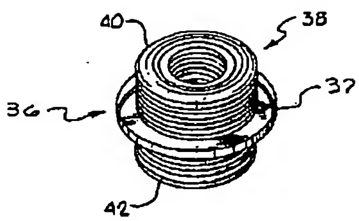
[Drawing 2]



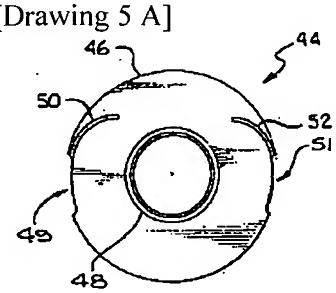
[Drawing 3]



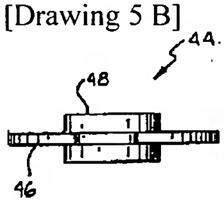
[Drawing 4]



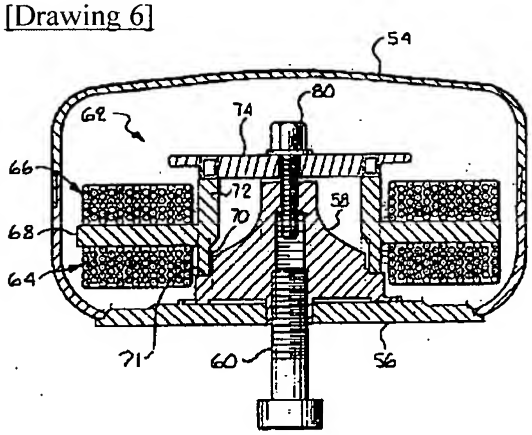
[Drawing 5 A]



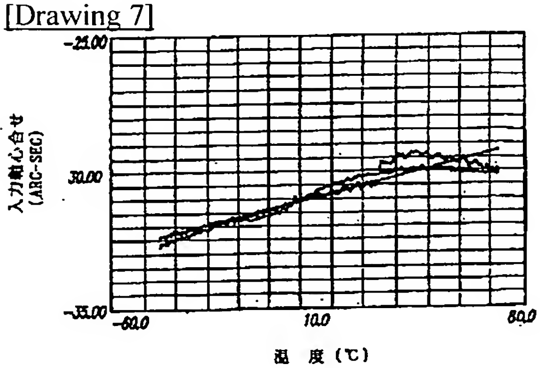
[Drawing 5 B]



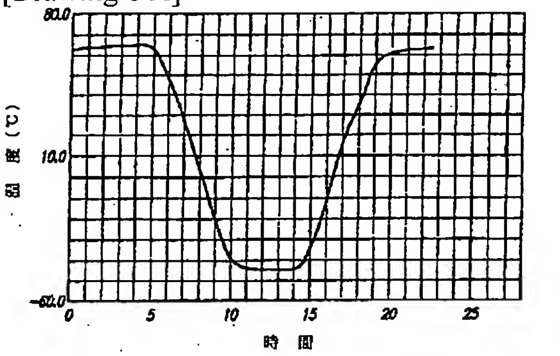
[Drawing 6]



[Drawing 7]



[Drawing 8 A]



[Drawing 8 B]